The HIGH PRESSURE STEAM TESTING LABORATORY

of

MANNING, MAXWELL & MOORE, INC.
[BRIDGEPORT WORKS]
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CONNECTICUT
General Offices: 100 East 42nd Street, New York City

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THE first large 1200 lb. boiler built in this country has been installed and put into operation by Manning, Maxwell & Moore, Inc., at its Consolidated Safety Valve Co. Works in Bridgeport, Conn. Primarily, the object of this installation is to actually test safety valves manufactured for the high pressure power plants now being built in this country. It has also enabled this Company, as manufacturers of Consolidated Safety Valves, to carry on the development work which has been necessary to design safety valves for these high pressures. The installation of this boiler assures the users of Consolidated Safety Valves that they have been tested at the exact pressures and under practically the same conditions which exist on their own boilers.

Operating pressures in power plants have increased successively to 400 lbs., 600 lbs. and now to 1200 lbs. As a result of the trend towards higher pressures, The Consolidated Safety Valve Co. anticipated the requirements of central power stations by installing a 1200 lb. test boiler before these stations were completed.

Consolidated Safety Valves have been furnished for practically all of the higher pressure stations now in operation, including:

The Trenton Channel Station of the Detroit Edison Co.

The Richmond Station of the Philadelphia Electric Co.

The Avon Station of the Cleveland Electric Illuminating Co.

which are approximately 400 lb. stations, equipped with Form DSA safety valves.

The Philo Station of the Ohio Power Co.

The Crawford Ave. Station of the Commonwealth Edison Co.

The Twin Branch Station of the Michigan & Indiana Electric Co.

The Miami Fort Station of the Columbia Power Co.

which are approximately 600 lb. stations, equipped with Form DSB safety valves.

The Weymouth Station of The Edison Electric Illuminating Company of Boston.

which has a 1200 lb. boiler equipped with Form DSC safety valves.

The boiler and superheater were designed and erected by The Babcock & Wilcox Co. The general engineering in connection with the installation was done by The Consolidated Safety Valve Co. In addition to its use for valve testing and development, The Consolidated Safety Valve Co. intends to use this high pressure laboratory for general research and development work.

Figure No. 1

is a front view of the boiler showing the cross drum made specially large to give the necessary volume of steam required to properly test and adjust safety valves of large capacities. This view also shows the general arrangement of the boiler accessories, such as feed line, water column, water gauge and drains, blow-off valves, soot blowers, pressure gauge and oil control.

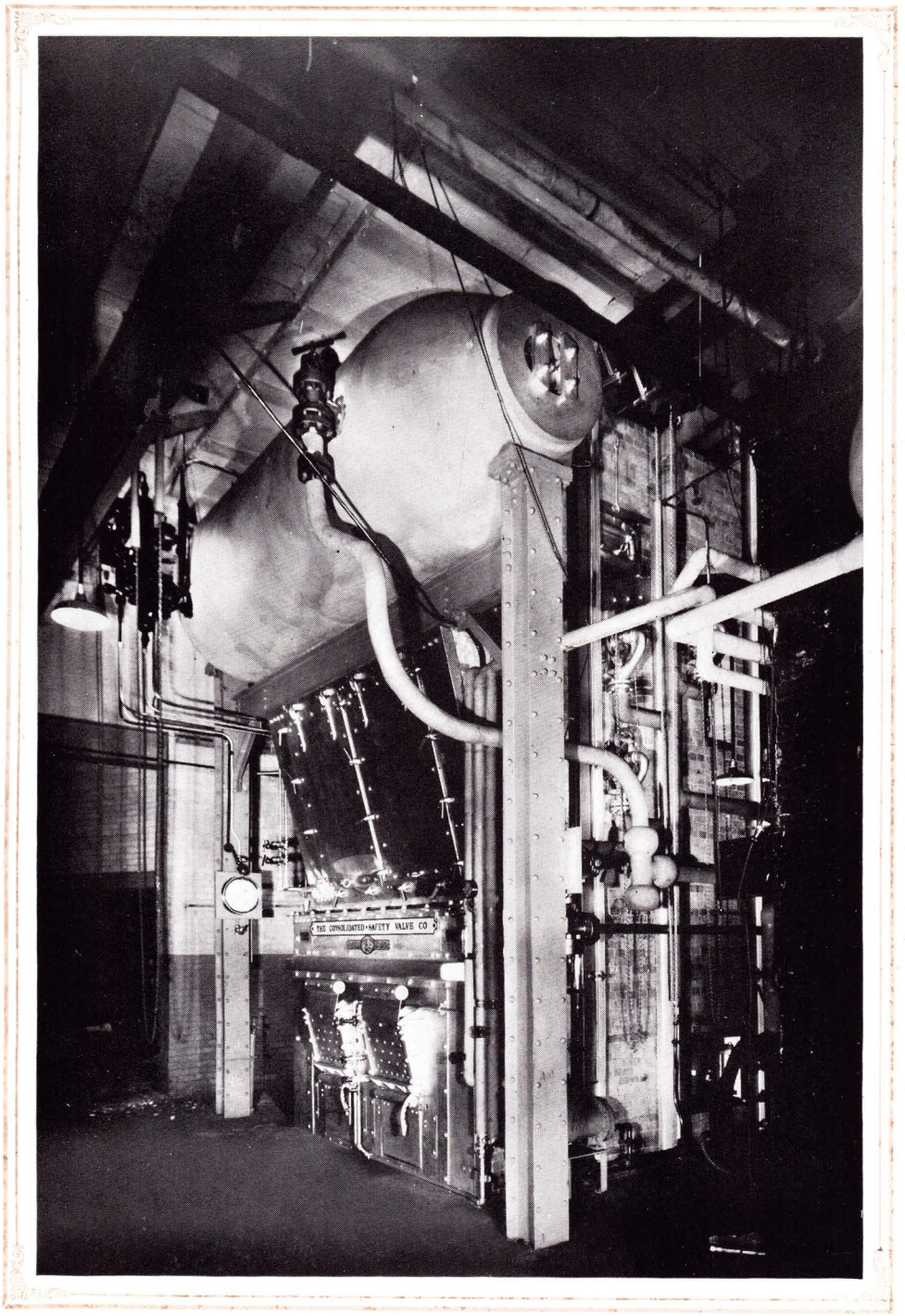

Figure No. 1

Figure No. 2

taken during erection, shows the general arrangement of the drum, circulating tubes, boiler tubes and headers, and at the extreme right, superheater tubes and manifolds. One of the novel features of the boiler is the fact that it can be operated for either superheated or saturated steam by control of stop valves between drum and superheater and of special flue dampers. The superheater temperature can be varied to a maximum temperature of 800° Fahr.

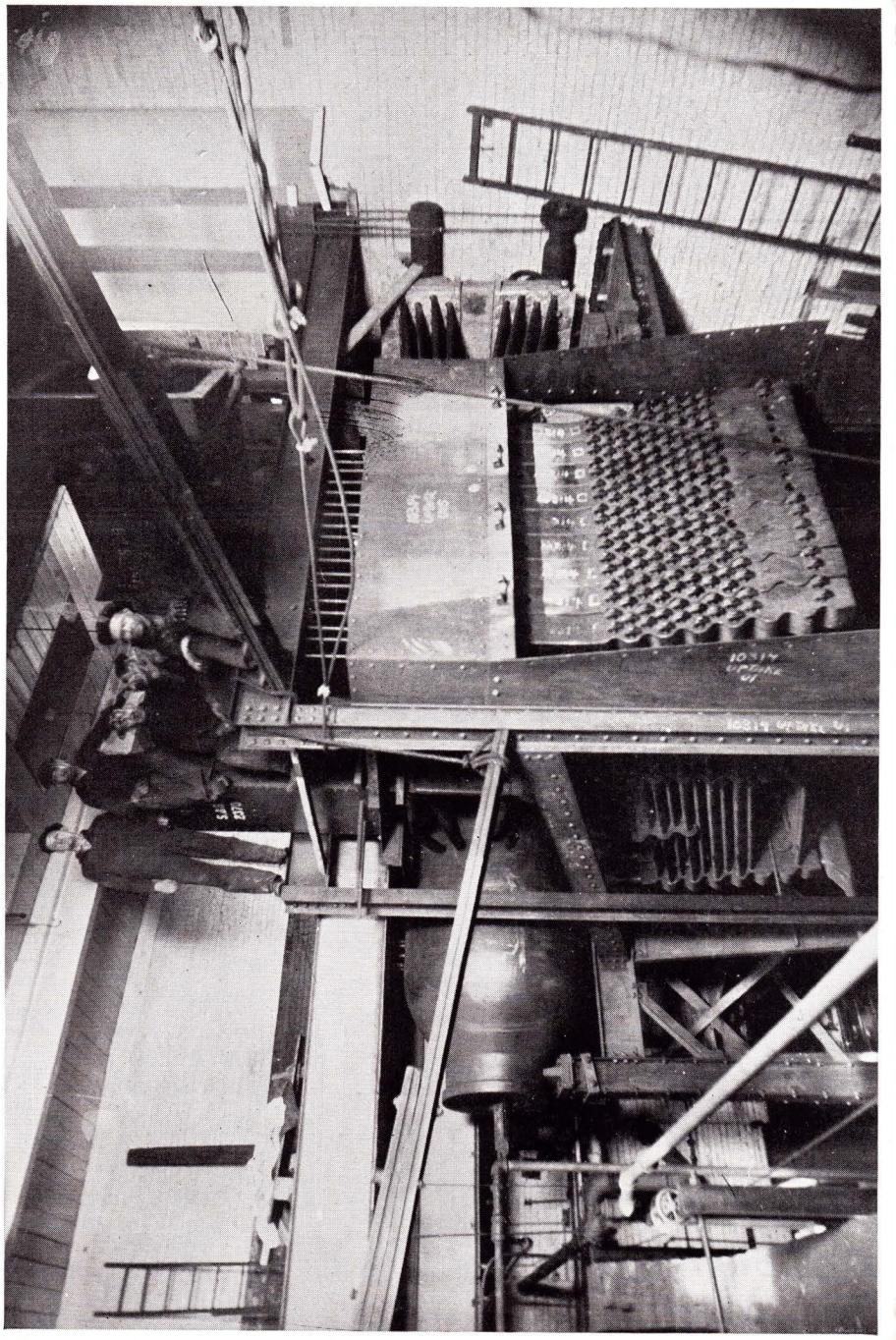

Figure No. 2

Figure No. 3

is a view of the rear or uptake end of the boiler when completely installed, showing the superheater box in the upper right hand corner. The superheater inlet and the end of the upper superheating manifold equipped with two Hancock steel body high pressure drain valves are also shown.

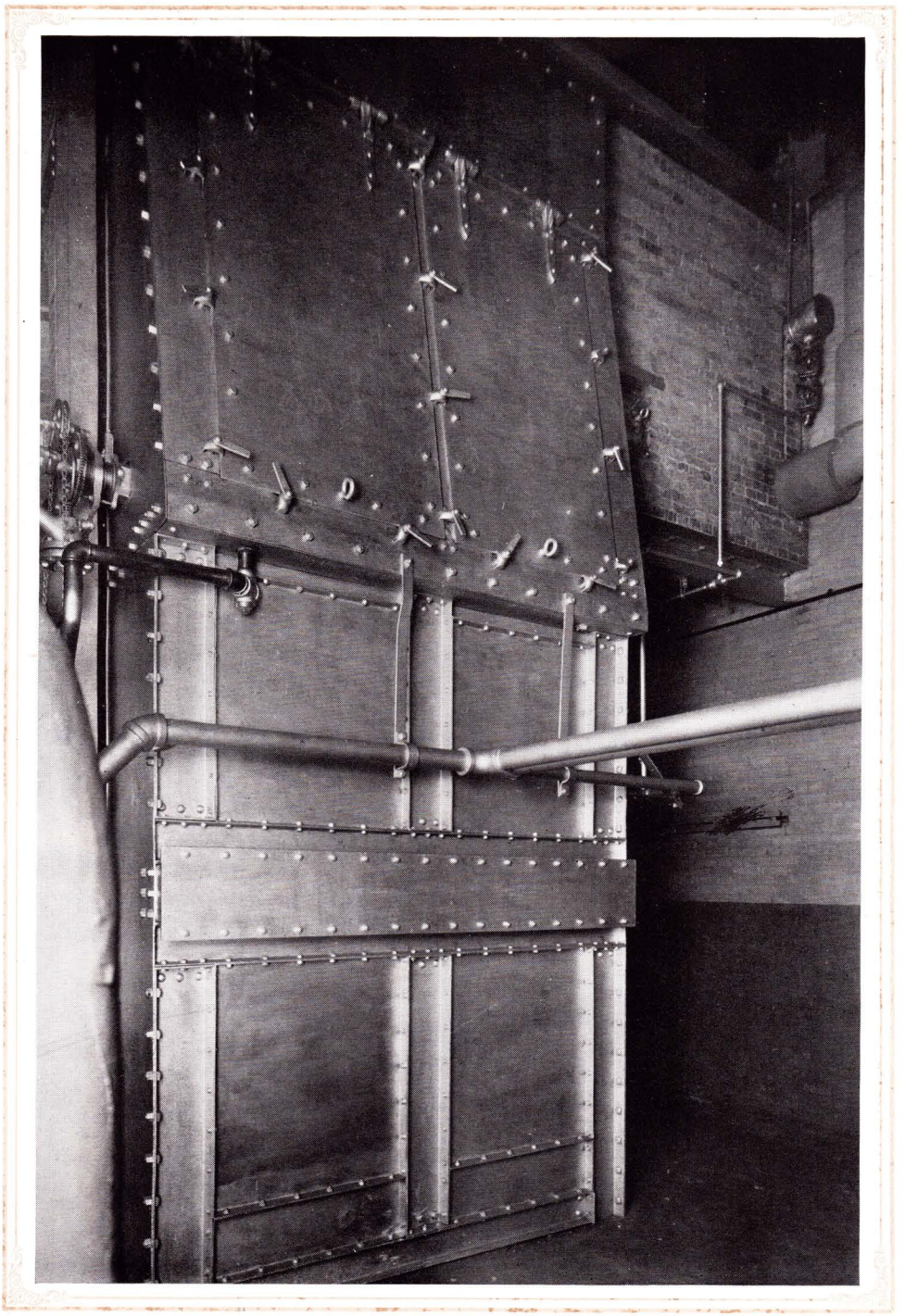

Figure No. 3

Figure No. 4

shows the drum during erection. This drum was forged from an ingot casting weighing 120,000 lbs. and has a finished weight of 43,435 lbs. It is 16 ft. over-all, 48″ inside diameter with a minimum wall thickness of 4″. The holes shown in drum are to admit the circulating tubes. One of the two man-holes provided at either end of the drum is also shown.

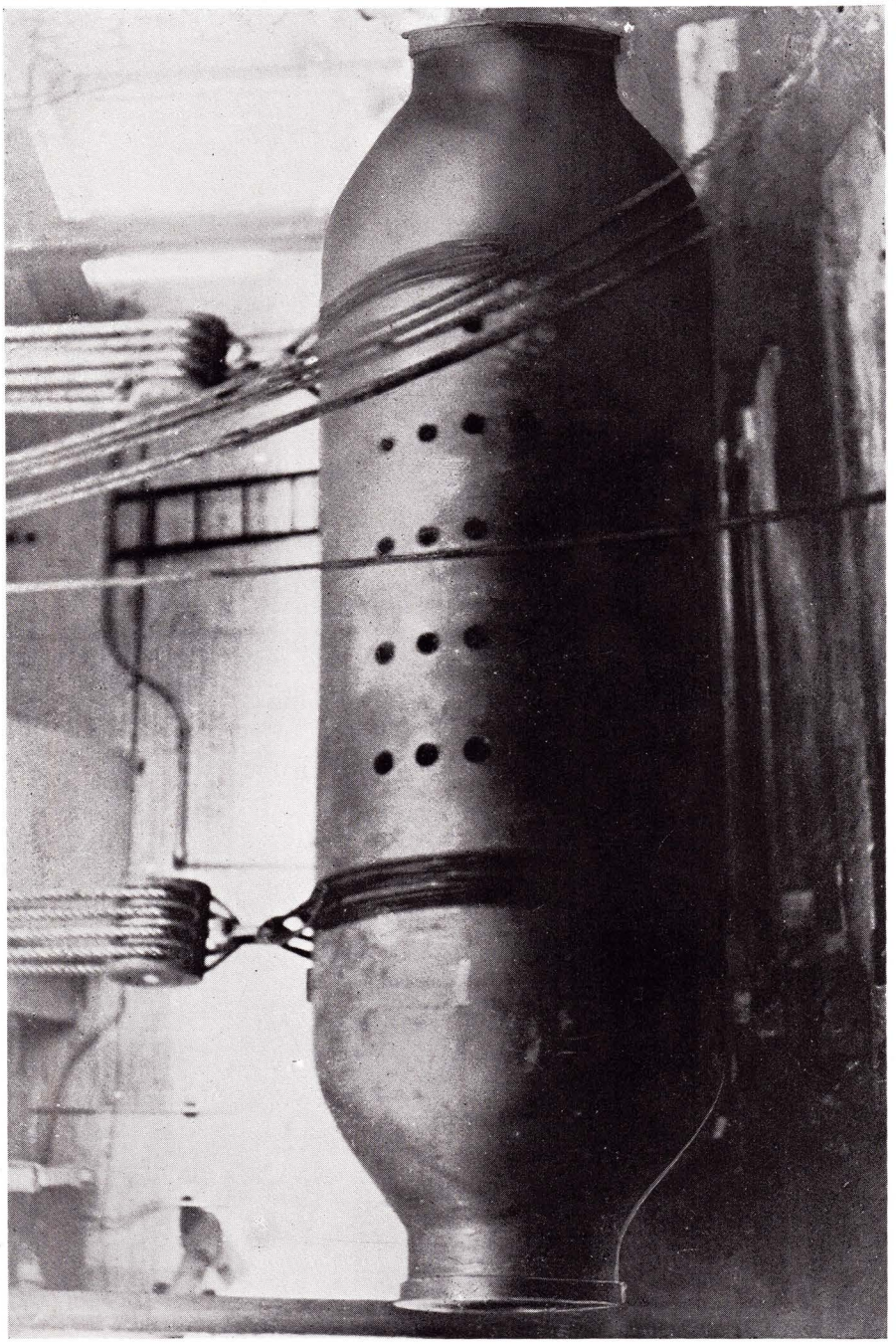

Figure No. 4

Figure No. 5

shows drum completely installed and covered. The water column and water gauge glasses can be seen at the left. The covered pipe in the center of the view is the feed pipe leading from a Hancock steel body drum head stop and check valve which is attached directly to the drum and to an internal distributing pipe. The connection is also shown for a Bristol-Derr electrical water level indicator.

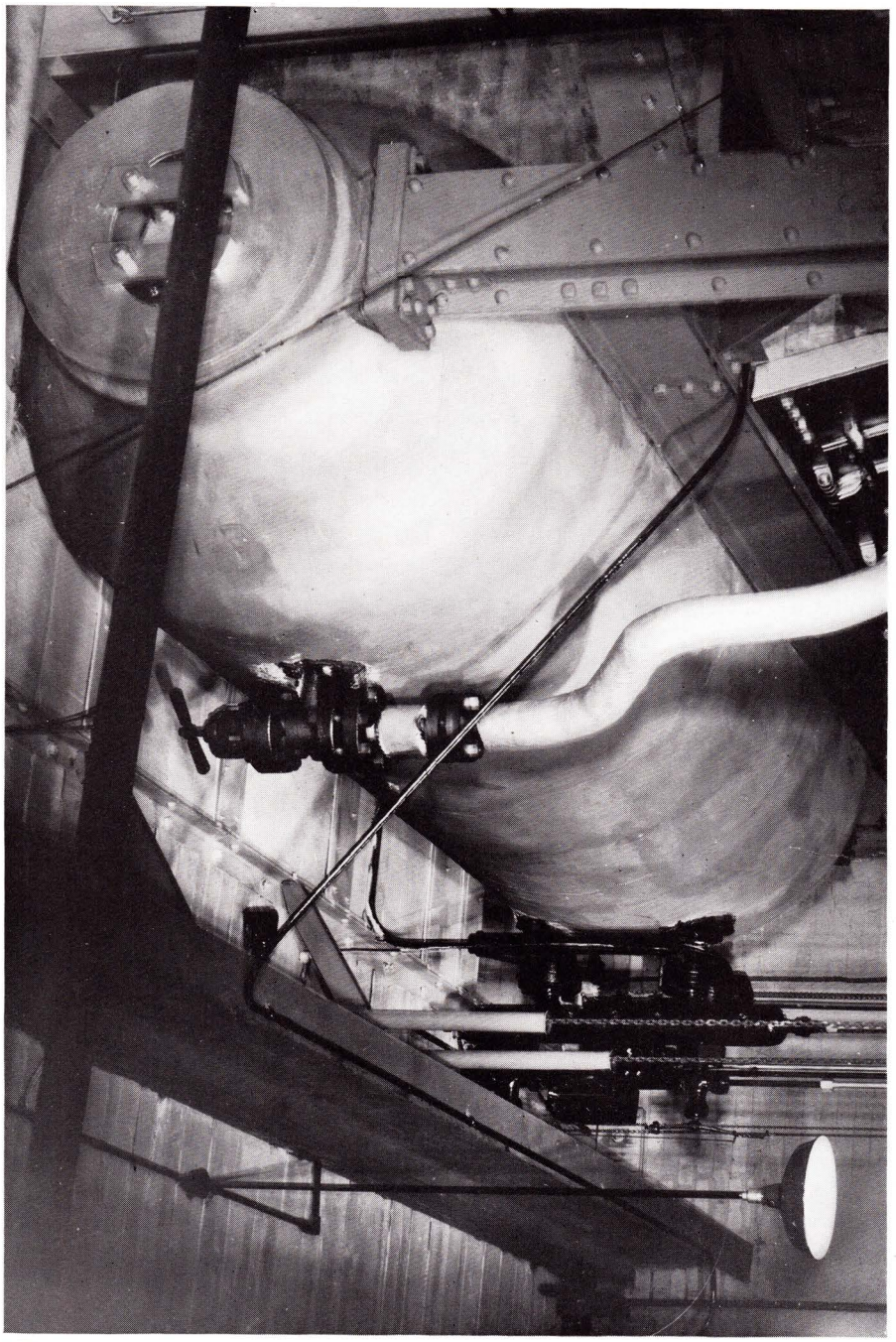

Figure No. 5

Figure No. 6

shows a Worthington single action pump which furnishes feed water to the boiler. The stop and check valves shown in the feed line are of the Hancock make. The feed line is of seamless steel tubing and all joints in this line, including those to the check and the stop and check valves, are of the Van Stone type with double step joints, having sheet Monel gaskets. This same double step Van Stone joint is used on all the high pressure connections throughout the installation. The flange bolts are made of special alloy steel.

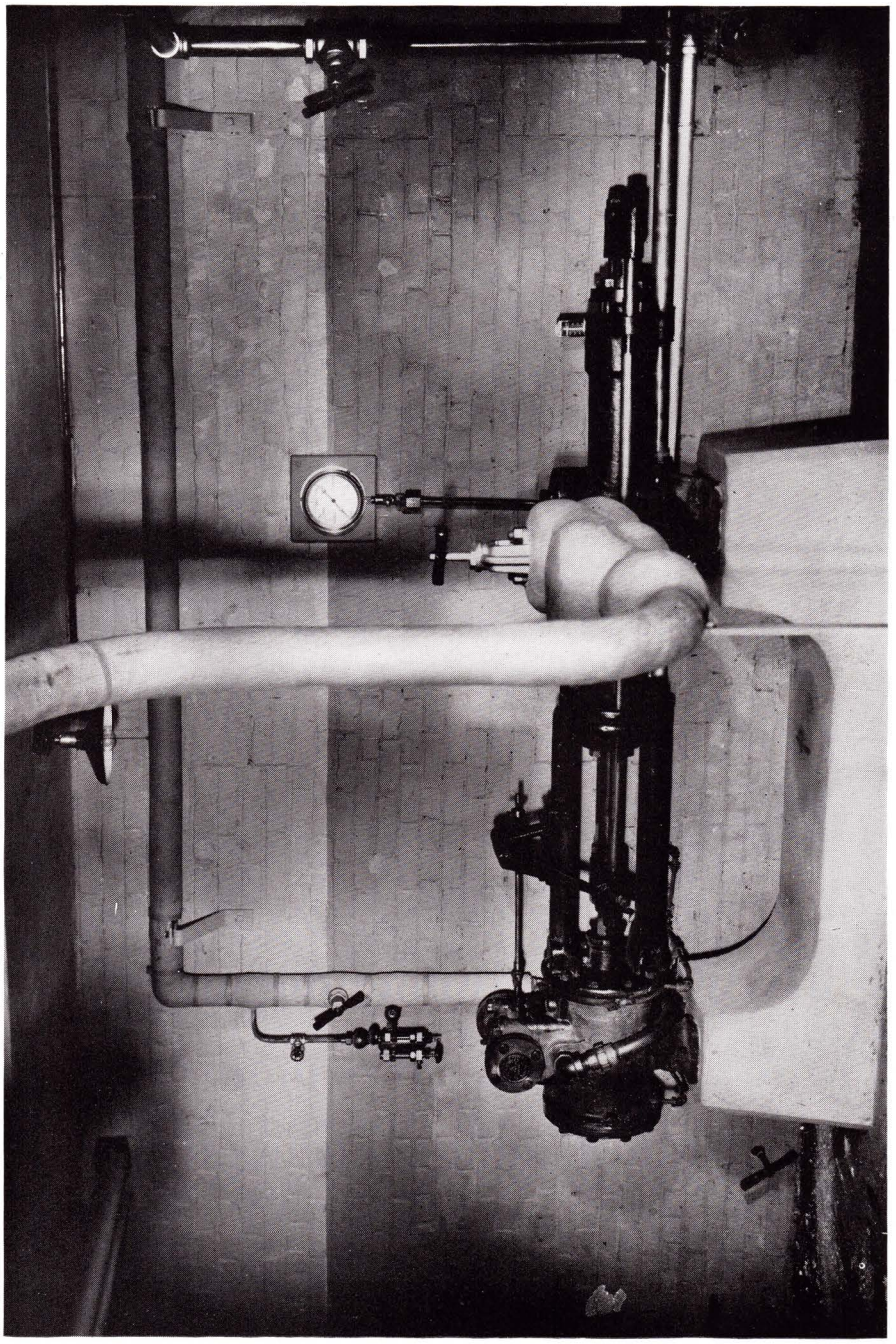

Figure No. 6

Figure No. 7

shows the water column and water gauge. These were designed and developed by The Babcock & Wilcox Co.

This fitting consists of a set of steel forgings, staggered at two levels, holding clear glasses backed up by mica arranged to give through vision.

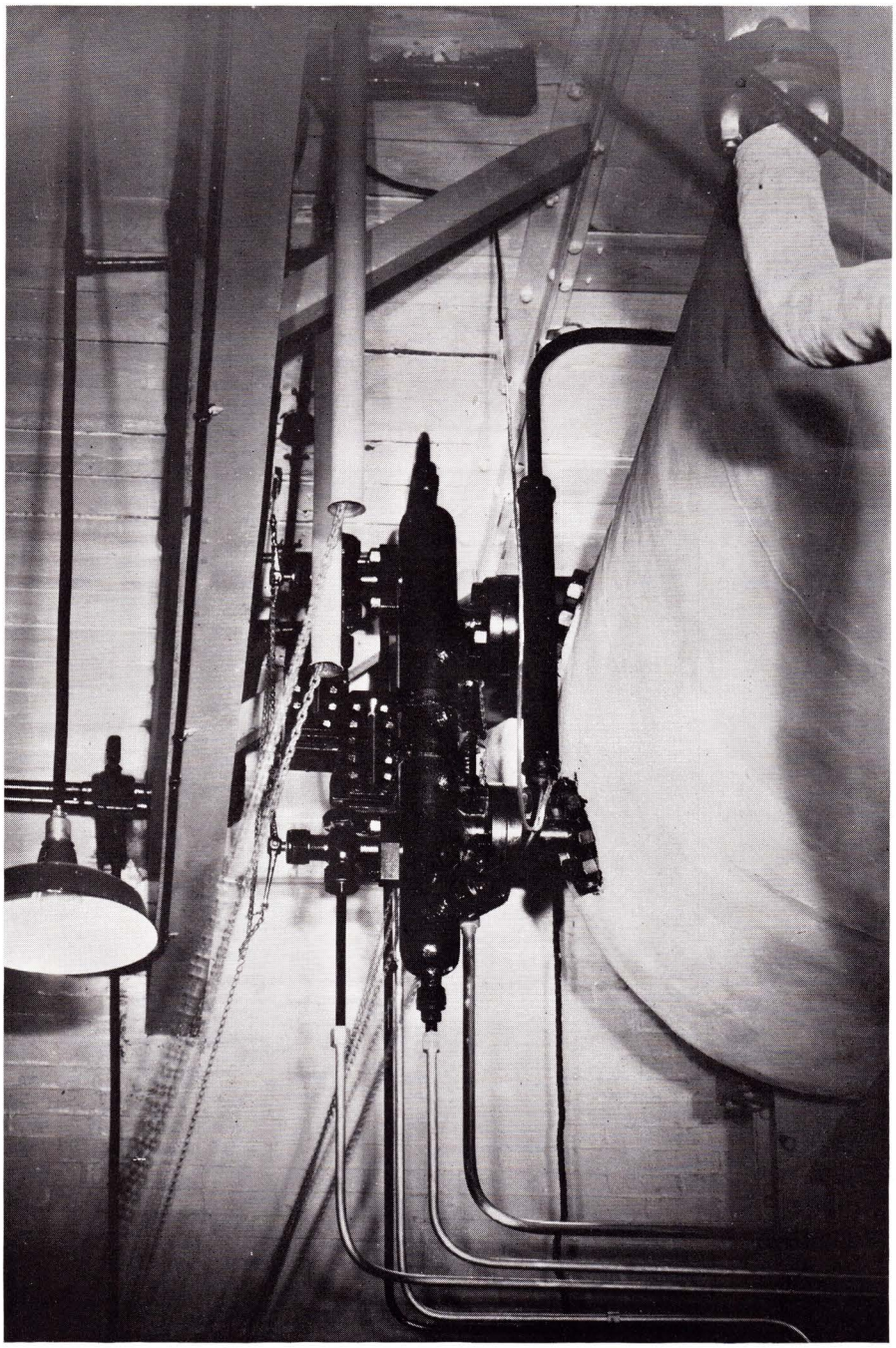

Figure No. 7

Figure No. 8

shows the installation of the Ashcroft boiler gauge and the water column and water gauge blow-off lines. The three high pressure lines for this service are equipped with Hancock forged steel valves threaded and welded to seamless tubing.

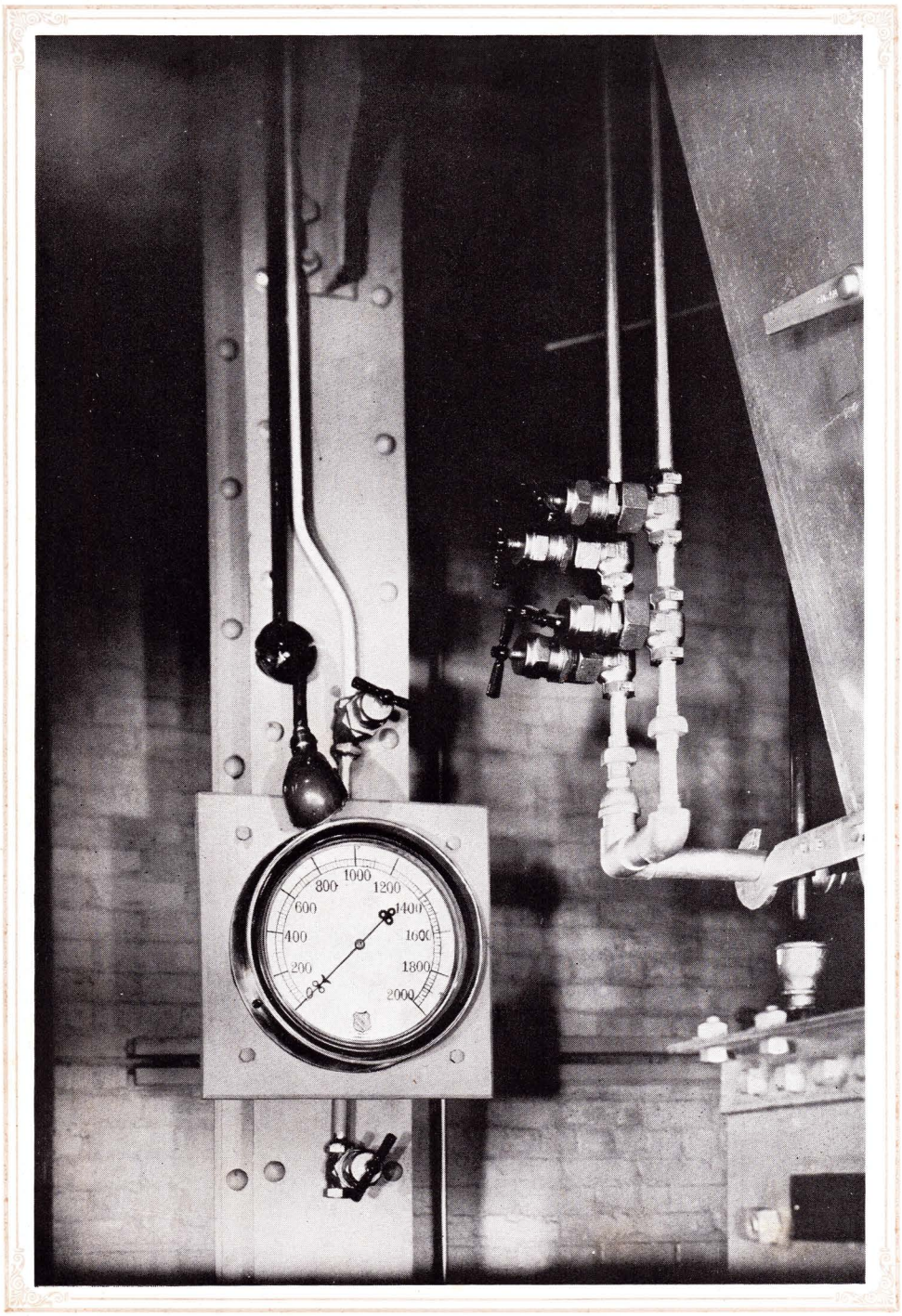

Figure No. 8

Figure No. 9

shows the installation of two special high pressure Hancock steel body blow-off valves. The valves are used here in tandem as in all of the other high pressure shut-offs, such as in the water column and water gauge lines, superheater drains and superheater bleeder.

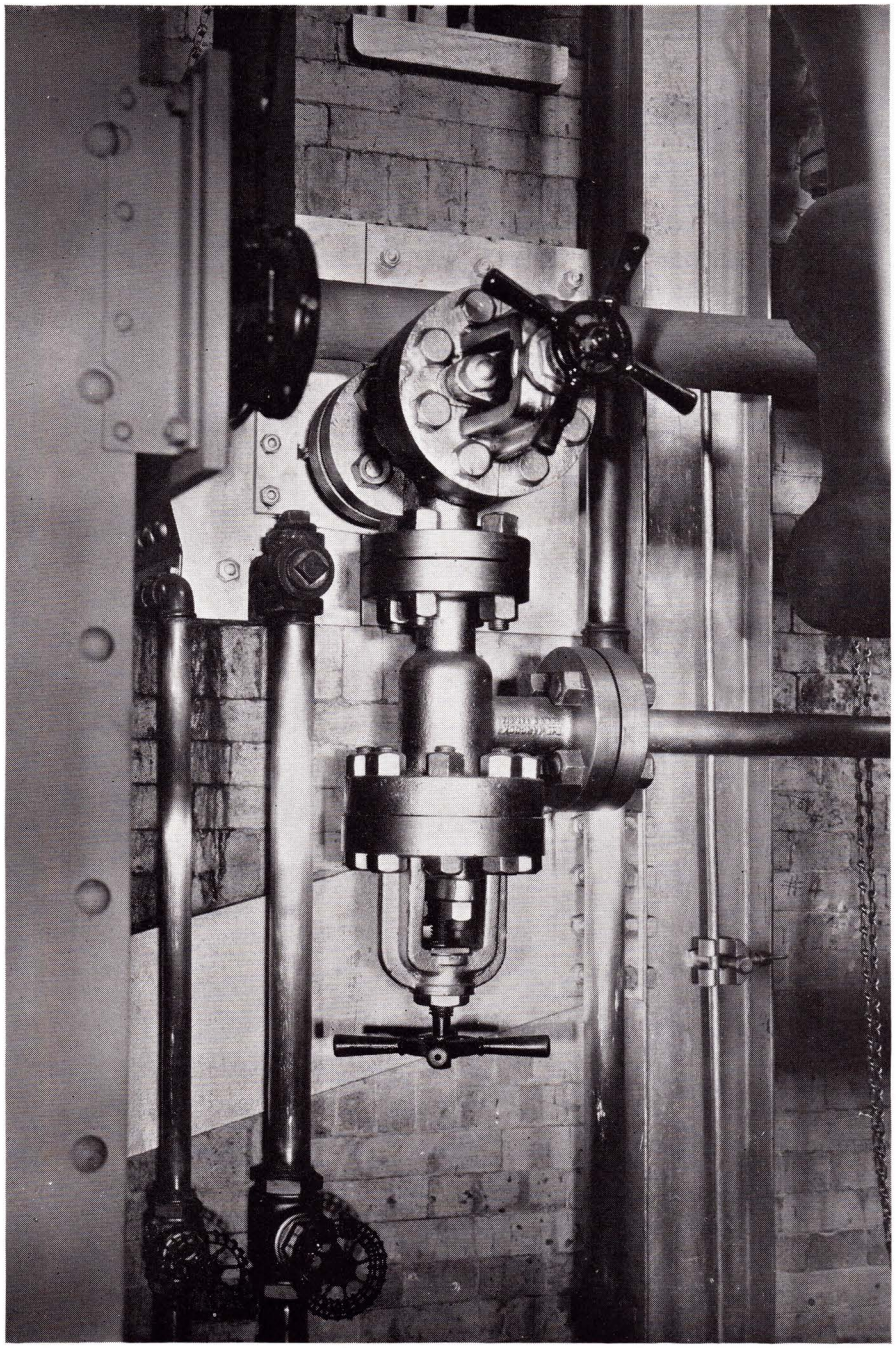

Figure No. 9

Figure No. 10

shows the general arrangement of the testing gallery. All of the equipment is located above the floor level on the five nozzles shown. The first nozzle in the right foreground carries a Y base and the two 1200 lb. Form DSE high pressure Consolidated Safety Valves required for the relief of the boiler. The second nozzle carries a special cross globe valve for supplying steam to lower pressure testing drums. A Form DSA Consolidated Safety Valve is mounted on top of this special cross globe valve for the purpose of preventing a pressure above 300 lbs. entering this line. The third nozzle is equipped with a special gate valve for the purpose of testing saturated steam safety valves. The fourth nozzle is used for the connecting pipe which carries steam to the superheater, this pipe being equipped with a gate valve. The fifth nozzle is the outlet from the superheater and is equipped with a special gate valve for testing valves under superheated steam.

The location of the gallery above the boiler drum, together with the radiation from the necessarily exposed parts, requires a ventilating system. This consists of a blower and exhaust system which displaces the air once a minute, keeping the temperature at a comfortable degree, even in the hottest weather.

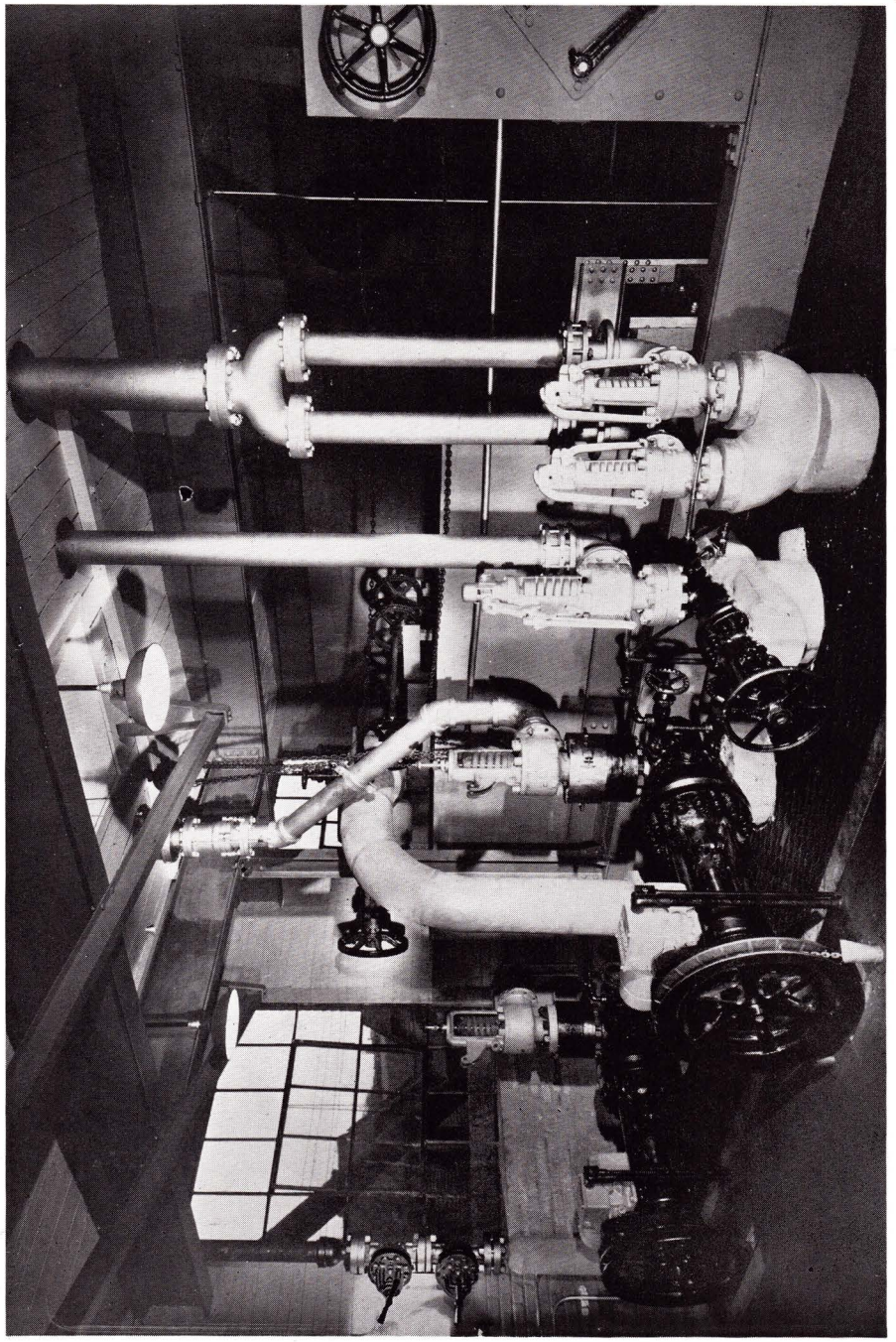

Figure No. 10

Figure No. 11

is a closeup view of the first and second nozzles shown in Figure No. 10. Safety valves shown on these two nozzles illustrate the method of piping the exhaust with slip joints to prevent the weight of the exhaust piping causing strains on the safety valves. These valves, and all of the safety valves used on this boiler, were designed specially for these high pressures by the engineers of The Consolidated Safety Valve Co.

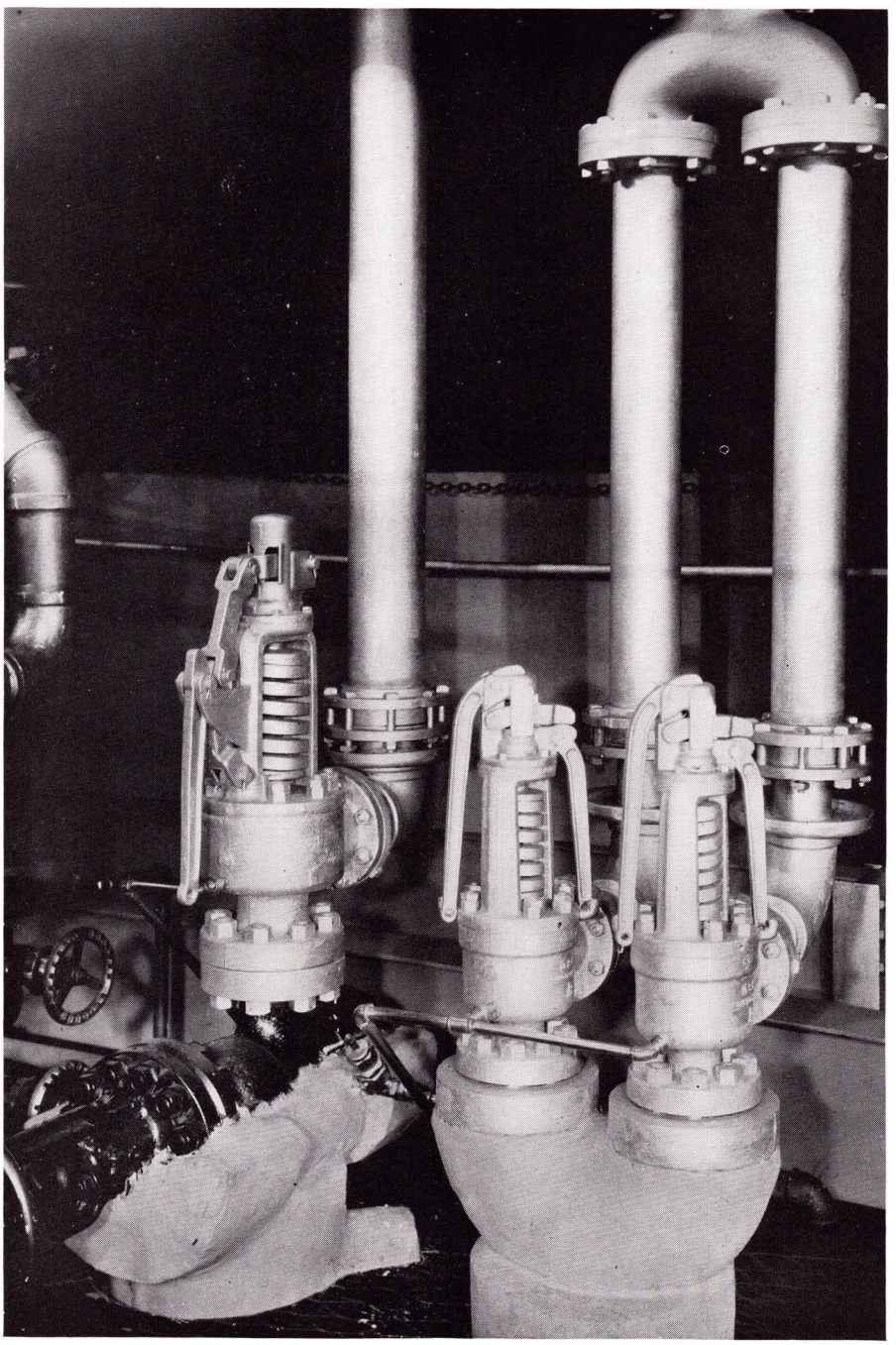

Figure No. 11

Figure No. 12

shows the testing unit for saturated steam safety valves, consisting of a 6″ Schutte-Koerting gate valve of the non-scraping type, closed by a Deane electrically operated control. The safety valves to be tested are mounted on the top of this gate valve, an adaptor being used between the safety valve and gate valve to take care of varying flange dimensions. This view shows the actual testing of one of the drum valves for the 1200 lb. boiler installed at the Weymouth Station of The Edison Electric Illuminating Company of Boston. These safety valves were actually tested and set for the maximum pressures at which they are to operate.

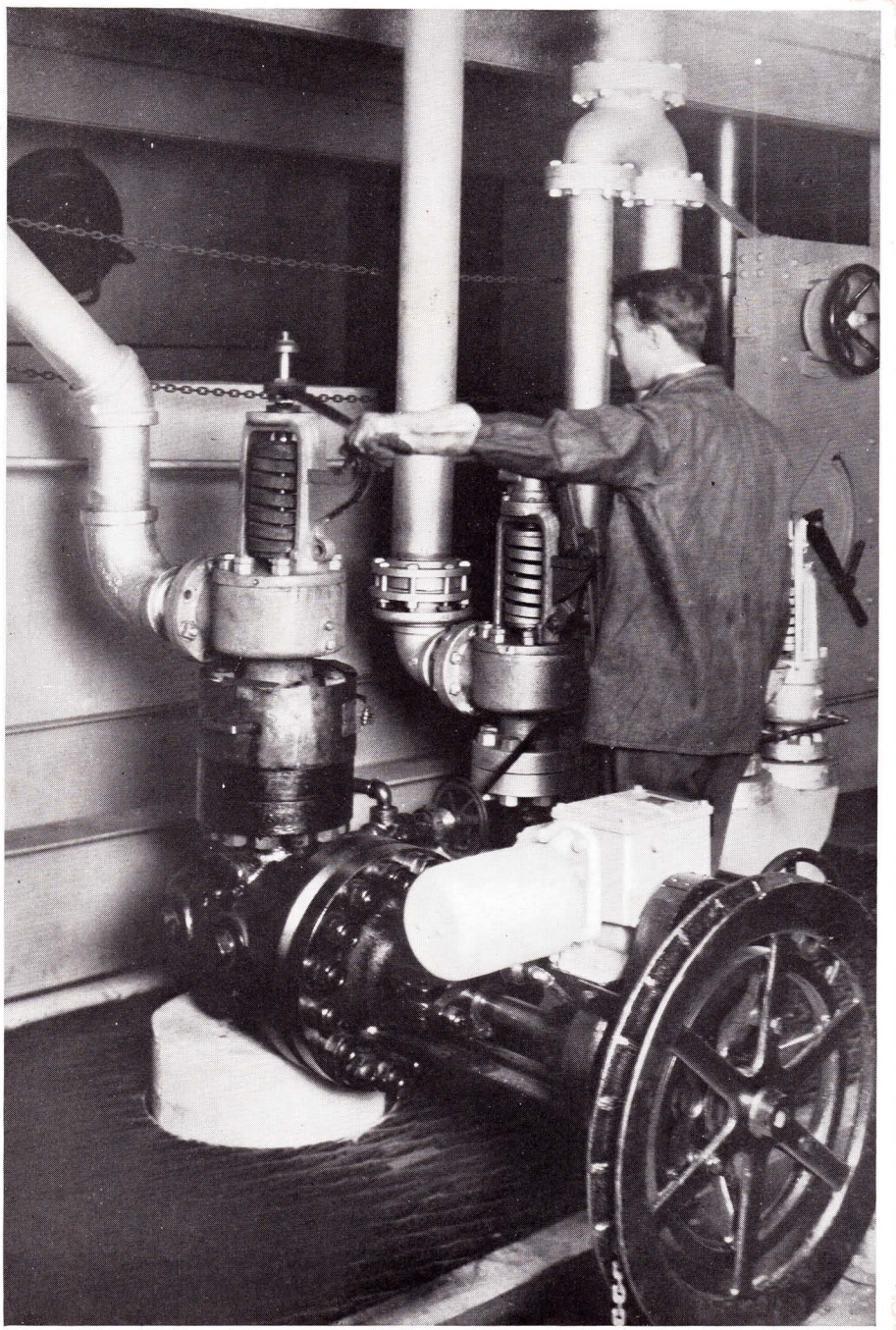

Figure No. 12

Figure No. 13

shows the superheater outlet equipped with Schutte-Koerting gate valve similar to that on the saturated nozzle shown in Figure No. 12. This is also a Deane electrically operated control. The view shows the testing of a superheater safety valve. The superheater bleeder valves, which are of The Hancock make, are shown in the vertical pipe to the right of the Ashcroft test gauges showing the saturated and superheated steam pressures.

In case of a failure of a water gauge glass, the cocks can be closed from the testing gallery by means of a cable with handle attached, shown directly beneath the pipes leading to the test gauges.

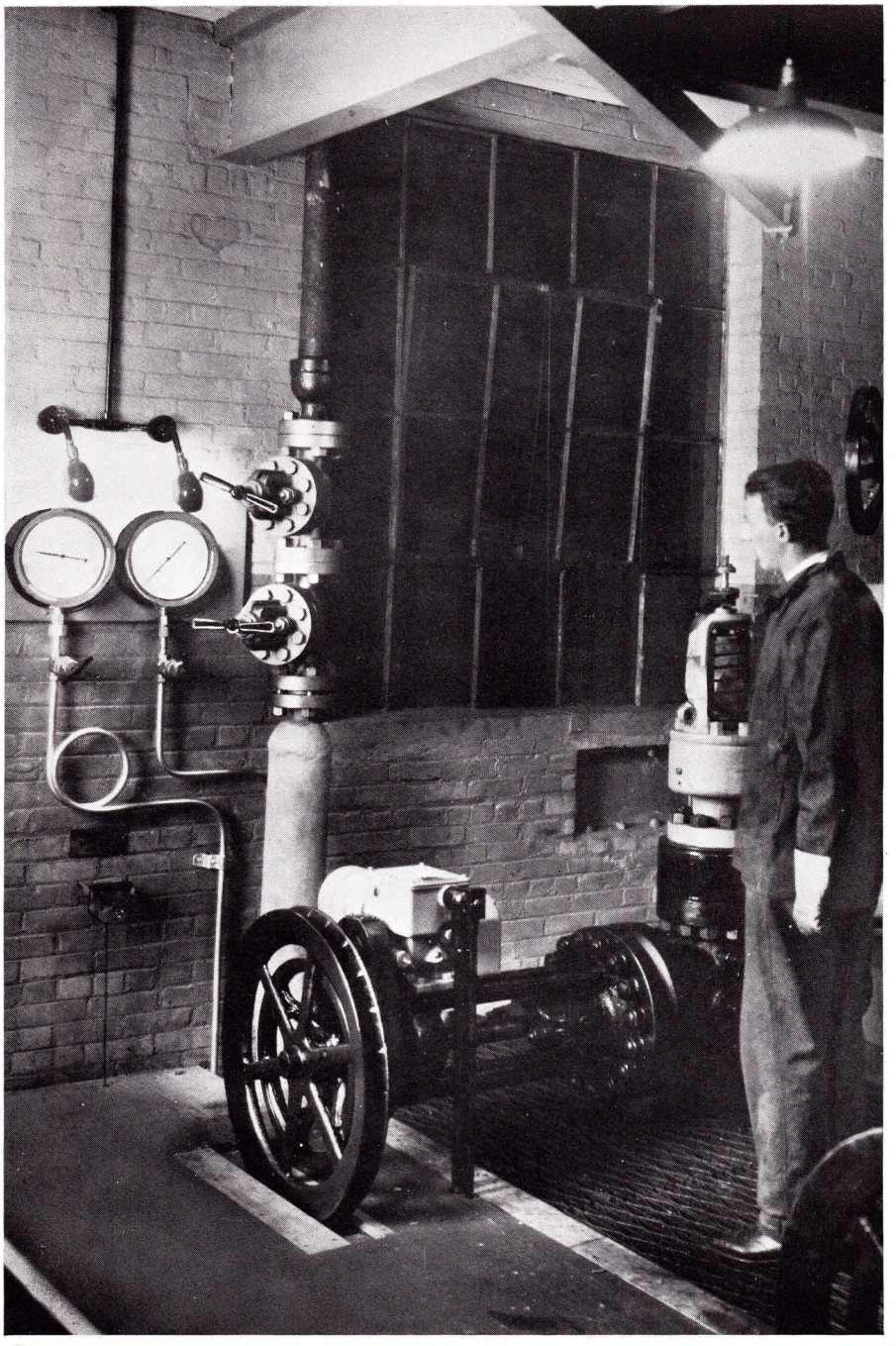

Figure No. 13

Figure No. 14

shows the remote control for the Deane electrically operated Schutte-Koerting gate valves located on the test nozzles and provision for shutting off the oil fuel from the testing gallery. The operation of the boiler while testing safety valves is very interesting, both from the standpoint of quick control and safety. The boiler is fired by a Ballard oil burner which is started and stopped by direction from the test gallery, by means of an electric horn. In the testing of the 1200 lb. safety valves for the Weymouth Station, the pressure could be run up to the popping point and dropped again as quickly as when operating at lower pressures, thereby giving the engineers, who set the valves for popping pressures and blow down, opportunity to adjust them accurately and quickly. Extreme flexibility is the key note of the operation of this test boiler.

It is possible to close the gate valve on the test nozzle in nineteen seconds against a flow of 85,000 lbs. of steam per hour. While ordinarily, the control of the oil burner is directed by the engineer in charge by means of the horn, in case of difficulty, an emergency cut-off has been provided by means of a handle, shown in the lower center of Figure No. 14. This handle and connecting wire close the oil valve which is shown in the lower right hand corner of Figure No. 15.

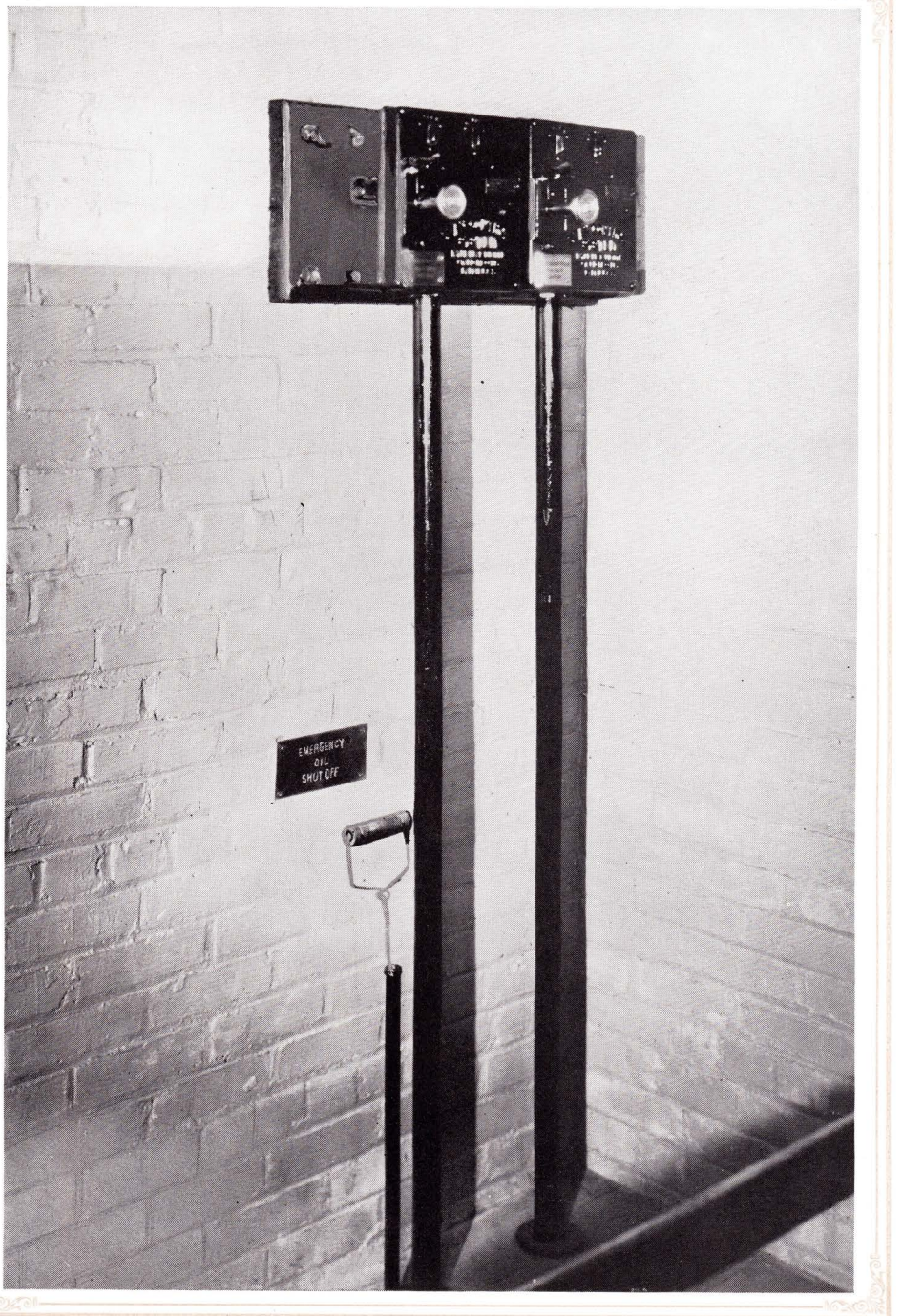

Figure No. 14

Figure No. 15

shows a view of the lower section of the boiler front with oil burning control and on the extreme right, provision for shutting off the fuel from the testing gallery, as indicated in Figure No. 14.

Figure No. 15

Figure No. 16

shows a large Maxim Silencer which is used to muffle the sound of steam being discharged from safety valves when tested. The discharge from both the saturated and superheated testing nozzles, also the boiler safety valves and superheater bleeder are all piped to one silencer. The inlet at the bottom which can be used for either saturated or superheated steam testing is 12 inches in diameter. The outlet from the silencer at the top end is 20 inches in diameter. The size is approximately 6 ft. in diameter by 10 ft. high, the weight being 6700 lbs.

When testing any one of the Form DSA, DBS or DSC safety valves at any pressure up to 1200 lbs., 35,000 lbs. of steam per hour are exhausted from the 20 inch outlet at the top of the silencer with a velocity of about 120 ft. per second. There is practically no back pressure in the silencer expansion chamber so that there is no interference with the proper action of the safety valves while being tested. This relatively low velocity also results in a very quiet discharge. As 125 ft. per second is considered permissible for quiet action by the Maxim Silencer Co., a considerable leeway for larger capacities has been provided.

Figure No. 16 also shows the arrangement of the safety valve exhaust pipes to the silencer.

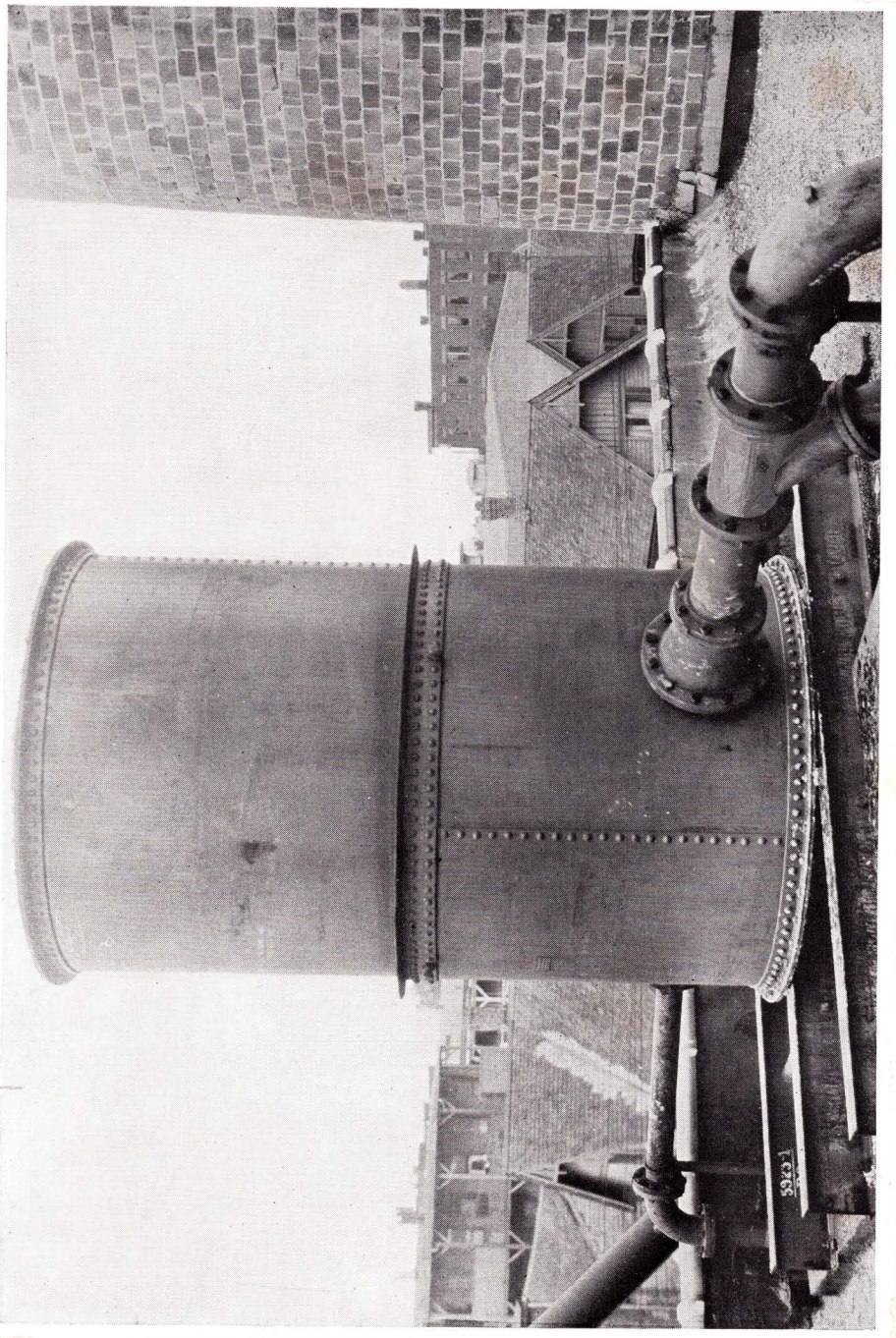

Figure No. 16

Figure No. 17

is a general view of the roof of the high pressure boiler house, showing the Maxim Silencer discharging steam at the rate of 60,000 lbs. per hour. From the street there is very little more noise than would be caused by the discharge of a low pressure valve.

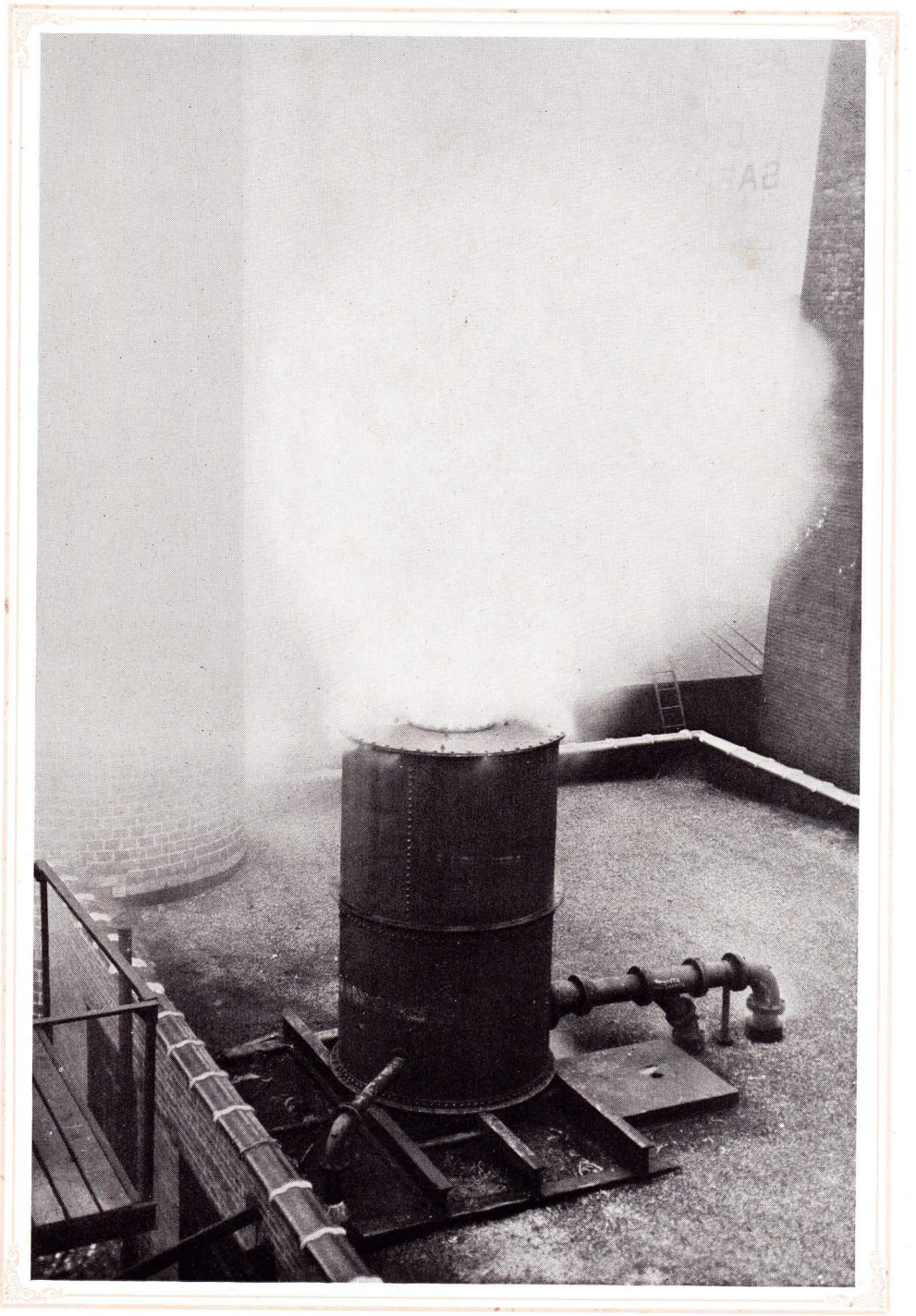

Figure No. 17

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